June 14, 2000

Mr. Karl Jacobs, Chairman
Westinghouse Owners Group
Indian Point Unit 2
Broadway & Bleakley Avenue
Buchanan, NY 10511

SUBJECT: SAFETY EVALUATION RELATED TO TOPICAL REPORT WCAP-14986, REVISION 1, "WESTINGHOUSE OWNERS GROUP POST ACCIDENT SAMPLING SYSTEM REQUIREMENTS" (TAC NO. MA4176)

Dear Mr. Jacobs:

By letter dated October 27, 1998 (OG-98-108), the Westinghouse Owners Group (WOG) submitted Topical Report WCAP-14986-P, Revision 1, "Post Accident Sampling System Requirements: A Technical Basis," for NRC staff's review to eliminate requirements on the post accident sampling system (PASS) for Westinghouse nuclear power plants (NPP). The WOG supplemented its application with letters dated April 28, 1999 (OG-99-041), and April 10, 2000 (OG-00-025), that (1) provided responses to a request for additional information, and (2) revised the topical report, respectively. The proprietary information designation was removed from the topical report in the Westinghouse letter dated May 22, 2000 (NSBU-NRC-00-5971).

The enclosed safety evaluation addresses the staff's review of WCAP-14986, Revision 1, for Westinghouse NPP. The staff concluded that the topical report provided a basis to eliminate the PASS as a required system for sampling the 15 parameters that are listed in Section 4 of the safety evaluation. In doing this, the staff also identified four licensee required actions (LRAs), in Section 4.1 of the safety evaluation, that must be fulfilled by a licensee of a Westinghouse NPP that would eliminate PASS in accordance with WCAP-14986 and the safety evaluation. In eliminating PASS, licensees do not have to incorporate the core damage assessment methodology (CDAM) in WCAP-14696, "Westinghouse Owners Group Core Damage Assessment Guidance," into their procedures, but they would need to assess the impact of elimination of PASS on their existing CDAM. This WCAP was approved in our letter of September 2, 1999, to the WOG. See Section 5.0 of the enclosed Safety Evaluation.

Because some licensees have the PASS in their emergency plans (EP) and may want to remove the system from the plan, the third LRA concerns the licensee's determination of the effect of eliminating PASS on the effectiveness of the EP. Based on the enclosed safety evaluation, the staff concludes that eliminating the PASS for sampling the 15 parameters listed in the safety evaluation should not decrease the effectiveness of the EP; however, the licensee must make its own independent determination as to the effect of eliminating the PASS on the effectiveness of its plant-specific EP before the system may be removed from the plan. If a licensee should determine that the effectiveness of the EP is not decreased, then the removal of the PASS would not require staff approval in accordance with 10 CFR 50.54(q).

As stated in the safety evaluation, the staff concludes, based upon the justification provided in WCAP-14986, that there is reasonable assurance that the health and safety of the public will not be endangered by operation of Westinghouse NPP without PASS. Therefore, it is acceptable to eliminate PASS from the licensing basis for the Westinghouse NPP.

The NRC requests that the WOG publish an accepted version of the revised WCAP-14986 within 3 months of receipt of this letter. The accepted version shall incorporate this letter and the enclosed safety evaluation between the title page and the abstract, remove all proprietary designations from the topical report, and add an -A (designating accepted) following the report identification number (i.e., WCAP-14986-A). The accepted version shall also incorporate the expanded paragraph on containment sump pH in Section 3.13 of the enclosed safety evaluation. Our approval of the topical report is contingent on the removal of all proprietary designations from the topical report.

If the NRC's criteria or regulations change so that its conclusion in this letter, that the topical report is acceptable, is invalidated, WOG and/or the applicant referencing the topical report will be expected to revise and resubmit its respective documentation, or submit justification for the continued applicability of the topical report without revision of the respective documentation.

Sincerely,

/RA/

Stuart A. Richards, Director
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 694

Enclosure: Safety Evaluation

cc w/encl: See next page

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/***RA/***
Stuart A. Richards, Director
Project Directorate IV & Decommissioning
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Project No. 694

Enclosure: Safety Evaluation

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO WCAP-14986, "WESTINGHOUSE OWNERS GROUP

POST ACCIDENT SAMPLING SYSTEM REQUIREMENTS"

WESTINGHOUSE OWNERS GROUP

PROJECT NO. 694

1.0 INTRODUCTION

In its letter dated October 27, 1998, the Westinghouse Owners Group (WOG) submitted Topical Report WCAP-14986-P, Revision 1, "Post Accident Sampling System Requirements: A Technical Basis," to be reviewed by the staff for eliminating PASS requirements from Westinghouse pressurized water reactor nuclear power plants (NPP). The "-P" designates that the topical report contains proprietary information. The topical report was revised in the letter dated April 10, 2000, and the proprietary information designation was removed in the letter of May 22, 2000. Therefore, the topical report is now WCAP-14986, Revision 1 (i.e., WCAP-14986, or the topical report). The WOG also responded to a request for additional information in its letter of April 28, 1999.

WCAP-14986 evaluated the post accident sampling system (PASS) requirements to determine their contribution to plant safety and accident recovery. The topical report considered the progression and consequences of core damage accidents and assessed the accident progression with respect to plant abnormal and emergency operating procedures, severe accident management guidance, and emergency plans. WCAP-14986 concluded that many of the current PASS samples specified in NUREG-0737, "Clarification of TMI Action Plan Requirements," may be eliminated (i.e., remove the requirements to perform the sampling from the licensing basis), or the time for taking and analyzing the sample may be changed. For some sample types, the WOG recommended that the capability be maintained for long term recovery purposes, but with the PASS not being required within the licensing basis of the Westinghouse NPP. With PASS outside the licensing basis, there would be no requirements on the licensees to maintain and use the PASS; however, the licensee may elect to keep the PASS in the plant and use the system as long as it does not adversely affect safety-related systems.

Specifically, the WOG recommended in WCAP-14986 the following:

- Eliminate PASS sampling of reactor coolant system (RCS) dissolved gases.
- Eliminate PASS sampling of RCS hydrogen.
- Eliminate PASS sampling of RCS oxygen.

- Eliminate PASS sampling of RCS pH.
- Eliminate PASS sampling of RCS chlorides.
- Change the time required for obtaining and analyzing RCS boron from 3 hours to 8 hours. Change the accuracy criteria to: (1) 10% at a 1 sigma uncertainty for values above 1500 ppm, and (2) 20% of 1500 ppm, or 300 ppm, for values below 1500 ppm.
- Eliminate PASS sampling of RCS conductivity.
- Eliminate PASS sampling of radionuclides in the RCS.
- Eliminate PASS sampling of containment hydrogen.
- Eliminate PASS sampling of containment oxygen.
- Eliminate PASS sampling of radionuclides in the containment atmosphere.
- Eliminate PASS sampling of containment sump pH for plants that do not use brackish or salt water for the ultimate heat sink or have more than a single barrier between the cooling water and the containment or which have passive pH control.
- Eliminate PASS sampling of chlorides in the containment sump.
- Eliminate PASS sampling of boron in the containment sump.
- Eliminate PASS sampling of radionuclides in the containment sump.

2.0 BACKGROUND

The need for a PASS was one of the findings endorsed by the NRC following the accident at the Three Mile Island (TMI) plant. The NRC specified that all licensed plants have the capability of obtaining and analyzing post-accident samples of the reactor coolant and containment atmosphere within specified times, without causing a radiation exposure to any individual that exceeds 5 rem to the whole body or 75 rem to the extremities. Detailed criteria for the PASS are specified in Section II.B.3 of NUREG-0737 including the following:

> The licensee and applicant shall establish an onsite radiological and chemical analysis capability to provide, within a three-hour time frame, quantification of the following:
>
> a) Certain radionuclides in the reactor coolant and containment atmosphere
>
> b) Hydrogen levels in the containment atmosphere
>
> c) Dissolved gases (e.g., hydrogen), chloride, and boron concentration of liquids

The TMI-related recommendations specified in NUREG-0737 were subsequently incorporated into 10 CFR 50.34(f)(2)(viii). However, this rule applied only to applications pending at that time (i.e., Perkins Nuclear Station, Units 1, 2, and 3; Allens Creek Nuclear Generating Station, Unit 1; Pebble Springs Nuclear Plant, Units 1 and 2; Black Fox Station, Units 1 and 2; Skagit/Hanford Nuclear Power Project, Units 1 and 2; and Offshore Power Systems).

On March 17, 1982, the NRC issued Generic Letter (GL) 82-05, "Post-TMI Requirements," in which the NRC requested that licensees establish a firm schedule for implementing post-accident sampling. On November 1, 1983, the NRC issued GL 83-36 and GL 83-37, "Technical Specifications," which provided guidance on how to address post-accident sampling in the technical specifications for boiling-water reactors (BWRs) and pressurized-water reactors

(PWRs), respectively. In GL 83-36 and GL 83-37, the NRC indicated that all licensees should establish, implement, and maintain an administrative program that would include training of personnel, procedures for sampling and analyses, and provisions for sampling and analysis equipment. The licensees could elect to reference this program in the administrative controls section of the technical specifications and include its detailed description in the plant operation manuals. However, the recommendations described in Section II.B.3 of NUREG-0737 were imposed as requirements for the majority of operating plants through license conditions or by orders.

Regulatory Guide 1.97, "Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident" (Revision 3, 1983), described acceptable means for licensees to comply with the Commission's regulations (Criteria 13, 19, and 64 of Appendix A to 10 CFR Part 50) to provide instrumentation to monitor plant variables and systems during and following an accident. Regulatory Guide 1.97 included a list of variables to be monitored which included the samples specified in NUREG-0737 and the following additional samples:

- pH in the RCS
- Boron, pH, chlorides, and radionuclides in the containment sump

Since these criteria for PASS have been issued, the NRC has performed three generic evaluations pertinent to the staff's evaluation of WCAP-14986, which are discussed below.

In the mid 1980s, the staff had a contractor review regulatory requirements that may have marginal importance to risk. One of the issues reviewed was the NUREG-0737 criteria for PASS. The conclusion reported in NUREG/CR-4330, "Review of Light Water Reactor Regulatory Requirements" (dated May 1987), was that several of the PASS criteria could be relaxed without impacting safety; however, the staff did not take action to modify the PASS criteria based upon the contractor's conclusions.

In 1993, during its review of licensing issues pertaining to evolutionary and advanced light water reactors, the staff evaluated requirements for PASS specified in 10 CFR 50.34(f)(2)(viii). The staff recommended to the Commission in SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-water Reactor (AWLR) Designs," (dated April 2, 1993), that: (1) elimination of hydrogen analysis of containment atmosphere samples is appropriate, given that safety-grade hydrogen monitoring instrumentation will be installed; (2) relaxation of dissolved gas (including dissolved hydrogen) sampling time to 24 hours is appropriate; (3) elimination of the mandatory requirement for chloride samples is appropriate; (4) relaxation of the boron sampling time to 8 hours after an accident is appropriate; and (5) relaxation of the sampling time for radionuclides (used to determine the degree of core damage) to 24 hours is appropriate.

In addition, in 1993, the staff evaluated the Combustion Engineering Owners Group Topical Report CEN-415, "Modifications of Post Accident Sampling System Requirements," (Revision 1, December 1991). In a letter dated April 12, 1993, the NRC approved: (1) deletion of pH measurement in the containment sump, (2) deletion of hydrogen sampling of the containment atmosphere, (3) deletion of sampling for iodine (if core damage assessment procedures are based on samples of xenon or krypton activities), and (4) deletion of oxygen analysis of reactor coolant.

Finally, in parallel with review of WCAP-14986, the staff also reviewed a Combustion Engineering Owners Group Topical Report (CE NPSD-1157, "Technical Justification for the Elimination of the Post-Accident Sampling System from the Plant Design and Licensing Bases for CEOG Utilities") which requested similar changes to PASS requirements for Combustion Engineering pressurized water reactors.

The staff considered the conclusions (and the basis for the conclusions) from these generic evaluations as part of its review of WCAP-14986.

3.0 EVALUATION

The NRC staff's review of the technical basis for each of the changes to PASS proposed in WCAP-14986 is discussed below.

3.1 Eliminate Pass Sampling of RCS Dissolved Gases

Dissolved gas sampling is specified in NUREG-0737 and Regulatory Guide 1.97; however, NUREG/CR-4330 suggests that it could be eliminated provided that vessel head gas vents and a reactor vessel level instrumentation system (RVLIS) are installed.

The main purpose of sampling for dissolved gases is to identify the potential of void formation in the vessel dome (and at the top of the steam generator U tubes) from dissolved gases when depressurizing, or even uncovering the core in case natural circulation needs to be used for decay heat removal.

Because RVLIS provides an indication of water level and the vessel head vent (which is safety grade) can easily vent non-condensable gases, both diagnosis and remediation is available. In addition, for plants not equipped with automated gas sampling systems, the delay between sampling and the availability of the results is long and of no practical significance in accident management.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of RCS dissolved gases is acceptable.

3.2 Eliminate PASS Sampling of RCS Hydrogen

PASS sampling of the reactor coolant for measurement of dissolved hydrogen is specified in NUREG-0737 and Regulatory Guide 1.97.

The main purpose of hydrogen sampling is to identify the potential of void formation in the vessel dome and the top of the U tubes in the steam generators or even uncovering the core when depressurizing. In addition, the amount of the dissolved hydrogen could act as a surrogate indicator for dissolved fission product and non-condensable gases. As in the case of dissolved gases, the vessel head vent and the RVLIS system can be used to both identify and vent non-condensable gases from the RCS when depressurizing in order to establish natural circulation in the RCS.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of RCS hydrogen is acceptable.

3.3 Eliminate PASS Sampling of RCS Oxygen

PASS sampling of the reactor coolant for measurement of oxygen is only recommended in NUREG-0737, but is specified in Regulatory Guide 1.97, whenever the RCS concentration of chlorides exceeds 1.5 ppm.

High concentrations of oxygen in the RCS can enhance stress corrosion cracking of stainless steel components caused by the presence of chlorides. However, the pH of the reactor coolant is usually adjusted by the automatic addition of a buffering solution to where stress corrosion cracking cannot occur, even with the dissolved oxygen present. The buffering is done by the addition of pH control through containment spray or by the addition of trisodium phosphate in the containment sump and the recirculation of water from the containment into the reactor coolant.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of RCS oxygen is acceptable.

3.4 Eliminate PASS Sampling of RCS Chlorides

PASS sampling of chlorides in the RCS is specified in NUREG-0737 and Regulatory Guide 1.97.

High concentrations of chlorides in the reactor coolant can cause stress corrosion cracking of stainless steel components in contact with the coolant. Chlorides are introduced into the RCS by the incoming water from external sources containing chlorides. For plants which use cooling water containing chlorides, the operators are aware when the ingress of contaminated water occurs and can take appropriate corrective actions to prevent corrosion damage.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of RCS chlorides is acceptable.

3.5 Eliminate PASS Sampling of RCS pH

PASS measurement of the reactor coolant pH is specified in Regulatory Guide 1.97.

Reactor coolant pH control is important for controlling stress corrosion cracking of stainless steel components and for iodine retention. However, PASS sampling of RCS pH is not needed since in the post-accident environment of Westinghouse NPP, the pH of the reactor coolant and the containment sump are usually adjusted by the automatic addition of a buffering solution via the containment spray system. For ice condenser plants, the ice baskets contain a buffering solution that is released as the ice melts. Other plants use passive means such as baskets of trisodium phosphate in the containment sump to ensure that the pH of the containment sump water following a design basis loss-of-coolant accident (LOCA) is within specified limits. Also, RCS pH can be satisfactorily estimated by calculations.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of RCS pH is acceptable.

3.6 Change Time Requirement for PASS Sampling RCS Boron from 3 Hours (after decision to do so) to 8 Hours (after plant reaches a stable state) and Relax Accuracy Criteria

PASS sampling of the reactor coolant for measurement of boron is specified in NUREG-0737 and Regulatory Guide 1.97. In addition, the staff recommended in SECY 93-087 that the capability to obtain PASS samples of RCS boron within 8 hours of accident initiation (after plant reaches a stable state) be maintained for advanced light water reactors.

The topical report states that knowledge of boron concentration is required to achieve cold shutdown and requests that boron be measured eight hours after the plant has been placed in a safe and stable state. WOG proposed to rely on emergency operating procedures (EOPs) to achieve such a shutdown. Although WOG recommended in WCAP-14986 that the capability to obtain RCS samples from the PASS system be maintained, WOG stated in a telephone call held August 20, 1999, that there were adequate indications and procedures available to mitigate an accident without obtaining a PASS sample for RCS boron. In its letter of April 10, 2000, WOG revised the topical report to recommend that boron sampling of RCS also be eliminated. The staff finds that RCS boron concentration is an essential parameter for the accident management and achieving a cold shutdown state; however, the plant EOPs provide for adequate boration through the transient and recovery stage such that the PASS measurement is not required.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling for RCS boron is acceptable and, therefore, the accuracy criteria for this measurement is no longer relevant.

3.7 Eliminate PASS Sampling of RCS Conductivity

The PASS sampling of the reactor coolant for measuring conductivity of the coolant is not specified in NUREG-0737, nor Regulatory Guide 1.97.

The measurement of reactor coolant conductivity is only for verifying pH measurements and it was never required by the NRC. Therefore, the staff concludes that the proposal to eliminate PASS sampling for RCS conductivity is acceptable.

3.8 Eliminate PASS Sampling of RCS Radionuclides

For the purposes of this discussion, reactor coolant sump sample analysis capabilities is also applicable for the containment sump sample. PASS sampling of the reactor coolant for measurement of radionuclides is specified in NUREG-0737 and Regulatory Guide 1.97. NUREG-0737 specifies that the PASS have the capability to promptly (i.e., within 3 hours) quantify certain radionuclides that are indicators of the degree of core damage. Furthermore, Regulatory Guide 1.97 specifies that the isotopic analysis serves the purpose of accident release assessment.

The topical report states that post accident measurement of RCS radionuclides is currently used to perform core damage assessment and to classify fuel damage events at the Alert level for emergency preparedness. In regards to core damage assessment, the topical report states that measurement of radionuclides with PASS is not needed because there are four independent overlapping procedures for estimating core damage; the first three of which do not utilize RCS radionuclide information (and are simpler to perform). The fourth procedure is intended to be a detailed precise methodology for quantifying core damage based upon RCS radionuclide information. The topical report states that there is little expectation that the RCS sample will provide sufficiently accurate information to improve upon assessments performed by the simpler procedures. The topical report states that the core damage assessment procedure should be changed to eliminate the procedure involving radionuclide measurement.

In regards to the use of radionuclide sample information for classifying events involving failed fuel, the topical report states that the event can be classified based upon the recognition of the initiating condition which caused the fuel failure rather than measurement of the degree of fuel failure. Furthermore, the topical report states that other indications of failed fuel, such as letdown radiation monitors, can be correlated to the degree of failed fuel.

The staff considers radionuclide sampling information to be useful in estimating the degree of core damage, but recognizes that there are limitations associated with its use, in particular regarding the time needed to obtain the sample. Therefore, the staff considers it more appropriate for emergency response purposes to estimate the degree of core damage based upon real-time indications.

In addition, the staff considers radionuclide sampling information to be useful in classifying certain type of events (such as reactivity excursion or mechanical damage) which could cause fuel damage without having an indication of overheating on core exit thermocouples. However, the staff agrees with the topical report contention that other indicators of failed fuel, such as letdown radiation monitors (or normal sampling system), can be correlated to the degree of failed fuel. (See Section 4.1, Licensee Required Actions, Items 1 and 2).

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of RCS radionuclides is acceptable.

3.9 Eliminate PASS Sampling of Containment Atmosphere Hydrogen Concentration

PASS sampling of the containment atmosphere for hydrogen measurement is specified in NUREG-0737 and Regulatory Guide 1.97.

WCAP-14986 states that at least one means of obtaining a measurement of the containment hydrogen concentration is required, and that either sampling and analysis of hydrogen using PASS or use of the safety-grade containment on-line hydrogen monitor would be acceptable provided appropriate timing and accuracy needs can be met. The capability to obtain an initial measurement within about 30 minutes of the onset of core damage, and at 10 to15 minute intervals thereafter, with an accuracy of plus or minus one volume percent hydrogen concentration, are specified.

The redundant, safety-grade, containment hydrogen concentration monitors are required by 10 CFR 50.44(b)(1) and NUREG-0737 Item II.F.1, and are relied upon to meet the data reporting requirements of 10 CFR Part 50, Appendix E, Section VI.2.a.(i)(4). NUREG-0737 Item II.F.1 specifies that the monitors are to be functional within 30 minutes of the initiation of safety injection. As such, the monitors are expected to be functional prior to generation and release of hydrogen. Regulatory Guide 1.97 specifies that the monitors have a range of 0 to 10 volume percent. The quantity of hydrogen released to containment in most severe accidents would result in concentrations within this range. However, in the event that random or spontaneous ignition does not occur, continued hydrogen production from such mechanisms as core concrete interactions and radiolysis of reactor coolant could result in the concentration exceeding the range of the monitors late in an event. Hydrogen concentration measurements for concentrations greater than 10 volume percent are necessary to support the assessment of the hydrogen combustion threat to containment in the WOG severe accident management guidelines (SAMG). In the absence of this information, licensee severe accident management decision-making would rely on default hydrogen production assumptions contained in the SAMG. Since grab sample analysis provides the only viable means of determining the actual hydrogen concentration once the hydrogen concentration exceeds the range of the monitors, there is value to retaining the capability for long term hydrogen concentration analysis of containment atmosphere grab samples.

The staff concludes that during the early phases of an accident, the safety-grade hydrogen monitors provide an adequate capability for monitoring containment hydrogen concentration and are an acceptable alternative to maintaining the capability to obtain and analyze containment atmosphere samples for hydrogen within 3 hours. Approval of the change regarding PASS sample analysis does not change the requirements contained in 10 CFR 50.44(b)(1), and criteria in NUREG-0737 Item II.F.1, and Regulatory Guide 1.97 regarding the need to establish containment hydrogen concentration monitoring within 30 minutes of the initiation of safety injection. The staff notes that the NRC recently issued a confirmatory order for Arkansas Nuclear One that replaced the requirement to establish hydrogen monitoring within 30 minutes of the initiation of safety injection with a functional requirement that allows the licensee the flexibility to determine the appropriate time limit for providing indication of hydrogen concentration in containment. This same mechanism is available to other licensees who were issued orders in the 1983 time-frame confirming their requirements made in response to NUREG-0737 Item II.F.1. The information provided in Section 5.9 of WCAP-14986 with regard to time requirements, together with consideration of plant-specific emergency action levels, EOPs, and SAMG, can be used by those licensees in establishing the plant-specific time limit. For licensees that were not issued orders confirming their requirements regarding NUREG-0737 Item II.F.1, a different action (other than a confirmatory order) may be appropriate for relief from the timing requirement for establishing post-accident hydrogen monitoring.

In view of the value of sampling the containment atmosphere for hydrogen to complement the information from the hydrogen monitors in the long term (i.e., by confirming the indications from the monitors and providing hydrogen measurements for concentrations outside the range of the monitors), the staff requires that licensees retain a capability for sampling the containment atmosphere during the later stages of accident response (see Section 4.1, Licensee Required Actions, Item 2), and recommends the analyzing of such samples for hydrogen .

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment atmosphere hydrogen concentration is acceptable.

3.10 Eliminate PASS Sampling of Containment Oxygen

PASS sampling of the containment atmosphere for oxygen measurement is specified in Regulatory Guide 1.97.

Containment oxygen measurement serves to ensure that the oxygen level does not reach the limit of deflagration or detonation with the generated hydrogen. Since in the post-accident environment the only source of oxygen is radiolysis of sump water, it is not expected that this source will cause a significant increase of oxygen above the initially existing concentration in the containment atmosphere.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment oxygen is acceptable.

3.11 Eliminate PASS Sampling of Radionuclides in the Containment Atmosphere.

PASS sampling of the containment atmosphere for radionuclide measurement is specified in NUREG-0737 and Regulatory Guide 1.97. NUREG-0737 specifies that the PASS have the capability to promptly quantify certain radionuclides that are indicators of the degree of core damage. Furthermore, Regulatory Guide 1.97 specifies that the isotopic analysis serves the purpose of accident release assessment.

PASS measurements of the containment atmosphere radionuclide concentration are used to estimate the degree of core damage and to refine the source term used in dose assessments. In turn, core damage estimates and dose assessments are used in evaluating the type and extent of public protective actions which may be warranted. The topical report states that PASS sampling of containment atmosphere radionuclides can be eliminated because these samples are not representative of the concentration of radionuclides which may be released to the environment. The basis for this conclusion is that the concentration of the radionuclides at the sample point may not be representative of the concentration in containment, the potential for revolitization of fission products upon containment depressurization, plate out of aerosols (e.g., cesium iodide or CsI) in the sample lines, and time delays associated with obtaining, processing and interpreting the sample during non-stable phases of the accident. In addition, the topical report stated that samples of the containment atmosphere could be obtained and analyzed without reliance on the PASS.

The staff recognizes that, as described in Supplement 3 to NUREG-0654, initial protection action recommendations (PARs) should be based upon plant indications of actual or projected core damage. Following this initial PAR, the licensee should continue assessment of the accident to determine whether the PAR should be modified (relaxation of the PAR should not occur until the source of the threat is clearly under control). In NUREG-0654, the NRC indicated that licensees' capability to perform this assessment should include the post accident sampling capability. Therefore, the staff's evaluation of the topical report's recommendation for elimination of sampling the containment atmosphere for radionuclides focused on the need for this information to support whether initial PARs should be modified.

The staff agrees with the topical report’s assessment regarding the limitations associated with obtaining representative samples of the containment atmosphere. The staff considers that these limitations should be taken into account when determining how to utilize the containment atmosphere sample information during an event. However, the staff position is that, due to these limitations, information obtained from PASS samples would not be a primary factor in licensee and offsite emergency response decision making regarding PARs during the early phases of an accident. The public comments received (discussed in the appendix attached to this safety evaluation) on the proposed staff action to eliminate PASS support this position. However, the staff considers that containment atmosphere sample information would provide the public additional confidence that the licensee understood the magnitude of any remaining threat that the accident may pose after plant conditions in the accident have stabilized. Therefore, the staff also concludes that a plan should be developed for sampling the containment atmosphere; however, the staff does not consider it necessary to have dedicated equipment to obtain this sample in a prompt manner. These plans should detail the plant's existing sampling capabilities and what actions (e.g., assembling temporary shielding) may be necessary to obtain and analyze highly radioactive samples. (See Section 4.1, Licensee Required Actions, Items 2 and 4).

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment atmosphere radionuclides is acceptable.

3.12 Eliminate PASS Sampling of Containment Sump Radionuclides.

Containment sump sampling is discussed in Section 3.8.

3.13 Eliminate Pass Sampling of Containment Sump pH for Plants that do not use Brackish or Salt Water for the Ultimate Heat Sink or have more than a Single Barrier Between the Cooling Water and the Containment or which have a Passive pH Control

PASS sampling of the containment sump for measurement of pH is specified in Regulatory Guide 1.97.

The value of containment sump pH plays an important role in controlling the post-accident chemistry of the containment sump water. If it becomes acidic, it can significantly affect chloride induced stress corrosion cracking of stainless steel components and retention of iodine in sump water. In most cases, the post-accident sump pH is maintained in an alkaline range either by passive pH control or by spray additives. However, there may be some accident sequences when the containment spray is not activated, and sump pH may then become acidic. In these cases, however, its value can be estimated with a sufficient degree of accuracy from the volumes and chemistries of the water incoming from different external sources that represent the major sources of acid. WOG recommended in WCAP-14986 that plants which (1) use brackish or salt water for the ultimate heat sink, (2) do not have more than a single barrier between the cooling water and the containment, and (3) do not have a passive pH control, should maintain pH sample capability. However WOG stated, in a telephone call held

August 20, 1999, that the sump pH can be estimated without obtaining a PASS sample for these plants.

In its letter dated April 10, 2000, WOG revised its topical report to eliminate the requirements for containment sump pH sample capability from PASS. In the telephone call of May 31, 2000, the WOG explained that plants even with brackish or salt water could eliminate PASS sampling for containment sump pH because of the passive or active pH control. Passive or active pH control is trisodium phosphate in the containment sump or sodium hydroxide as a containment spray additive, and all Westinghouse plants have one or the other pH control.

The WOG sent the following paragraph by telecopy to the staff. The following paragraph expands on Section 5.13 on the containment sump pH:

> For plants with passive containment sump pH control, the containment sump pH will be within the acceptable range for iodine retention and for chloride induced stress corrosion cracking, unless additional water (e.g., water addition in SAMG SAG-4 from the demineralized water storage tank) has been added to the containment sump. For plants with active containment sump pH control (typically via the containment spray additive tank), the containment sump pH will be within the acceptable range for iodine retention and for chloride induced stress corrosion cracking if the pH control is activated and no additional water (e.g., water addition in SAMG SAG-4 from the demineralized water storage tank) has been added to the containment sump. For the case where active containment sump pH control is not automatically actuated (e.g., automatic actuation of containment spray for small LOCA events), guidance is available for the plant engineering staff (see Section A.1.7 of Appendix A) to determine the need for pH adjustment via other means (e.g., manual actuation of containment spray). For the case of water addition to the containment sump, the plant engineering staff guidance described in Section A.1.7 of Appendix A recommends that the sump pH can be approximated from calculations of the containment sump level indication and the sources of water in the containment sump and the chemical composition of the water.

The WOG stated that it will add this paragraph to WCAP-14986 to expand its justification for eliminating the PASS sampling of containment sump pH. The staff considers containment sump sampling to be useful for confirming sump pH calculations and that unaccounted for acid sources have been sufficiently neutralized and, therefore, the staff requires that licensees maintain the capability to sample the containment sump (see Section 4.1, Licensee Required Actions, Item 2) and recommends that the licensees also maintain the capability to analyze the sample for pH.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment sump pH is acceptable.

3.14 Eliminate PASS Sampling of Containment Sump Chlorides

PASS sampling and measurement of the containment sump for chlorides is specified in Regulatory Guide 1.97.

High concentration of chlorides in the containment sump can cause stress corrosion cracking of stainless steel components and affect retention of iodine in containment sump water. For plants with fresh water cooling systems, the problem is minimal; but for the plants with brackish water (with a single barrier between the cooling water and the containment and without pH control) it may be a significant issue. However, the volumes and chloride concentrations of the incoming water from different sources are known and the resulting concentration of chlorides in the sump water can be estimated with a sufficient degree of accuracy.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment sump chlorides is acceptable.

3.15 Eliminate Pass Sampling of Containment Sump Boron

Sump boron concentration sampling and measurement is specified in Regulatory Guide 1.97. This sampling was not addressed in SECY 93-087.

The purpose of measuring boron concentration in the containment sump is to assure reactor subcriticality should sump water be used in the recirculation mode to cool the core. The refueling water storage tank (RWST) and the accumulator water have sufficient boron concentration to assure subcriticality at any time in the fuel cycle. For ice condenser containment plants, there is sufficient boron added to the ice that the melt has the concentration of the RWST. However, in instances where unborated water is introduced in the containment for emergency core cooling, the sump boron density will be lower. However, the sump level (and the corresponding amount of water) is known. Therefore, knowing the source of the added water will allow the boron concentration to be estimated. Therefore, the staff concludes that elimination of boron sampling of the containment sump is acceptable.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment sump boron is acceptable.

4.0 SUMMARY

The staff concludes that WCAP-14986 provides a sufficient technical basis to eliminate the following PASS criteria specified in NUREG-0737 and Regulatory Guide 1.97:

1. RCS dissolved gases
2. RCS hydrogen
3. RCS oxygen
4. RCS chlorides
5. RCS pH
6. RCS boron
7. RCS conductivity
8. RCS radionuclides
9. Containment atmosphere hydrogen
10. Containment atmosphere oxygen
11. Containment atmosphere radionuclides
12. Containment sump radionuclides
13. Containment sump pH

14. Containment sump chlorides
15. Containment sump boron

4.1 Licensee Required Actions

The staff has identified the following licensee required actions (as discussed in the above sections) that must be fulfilled by a licensee that would eliminate PASS for sampling the above 15 parameters in accordance with WCAP-14986 and the safety evaluation:

1. Establish a capability for classifying fuel damage events at the Alert level threshold (typically this is 300 microcuries per ml dose equivalent iodine). This capability may utilize the normal sampling system or correlations of sampling or letdown line dose rates to coolant concentrations.

2. Develop contingency plans for obtaining and analyzing highly radioactive samples of reactor coolant, containment sump, and containment atmosphere. These plans should detail the plant's existing sampling capabilities and what actions (e.g., assembling temporary shielding) may be necessary to obtain and analyze highly radioactive samples. The contingency plans do not have to be demonstrated. Because these are contingency plans, the staff concludes that, in accordance with 10 CFR 50.47 and Appendix E to 10 CFR Part 50 for emergency plans, these contingency plans must be available to be used by the licensees during an accident; however, these contingency plans do not have to be carried out in emergency plan drills or exercises.

3. The staff does not consider that changes as discussed in this topical report will result in a decrease in the effectiveness of the emergency plan, however the licensee must determine for its own plant(s) that no decrease in the effectiveness of the emergency plans will result from the removal/downgrade of the PASS.

4. Licensees will maintain offsite capability to monitor radioactive iodines.

For containment hydrogen concentrations, containment hydrogen monitors required by 10 CFR 50.44(b)(1) may not be eliminated because they are required by the regulations. Although no longer a requirement, the staff recommends that licensees maintain the capability to analyze a containment atmosphere sample for hydrogen during the later stages of accident response in order to support SAMG. For containment sump pH, the staff also recommends that the licensees maintain the capability to analyze the sump water for pH. The licensees maintaining the capability to take a sample from the containment atmosphere and sump is LRA 2 above.

Because some licensees have the PASS in their emergency plans (EP) and may want to remove the system from the plan, the third licensee required action above concerns the effect of eliminating PASS on the effectiveness of the EP. Based on the safety evaluation, the staff concludes that eliminating the PASS for sampling the 15 parameters listed in the safety evaluation should not decrease the effectiveness of the EP; however, the licensee must also make an independent determination on its own as to the effect of eliminating the PASS on the effectiveness of the EP before the system may be removed from the plan. If a licensee should determine that the effectiveness of the EP is not decreased, then the removal of the PASS would not require staff approval in accordance with 10 CFR 50.54(q).

Some licensees have the PASS in their Technical Specifications (TSs). Removing PASS from the TSs is a license amendment that requires staff approval in accordance with 10 CFR 50.90. In submitting a license amendment, the licensees must address LRAs 1, 2, and 4, and describe how and when they will be implemented at the plants. The description is expected to be a reference to the applicable SAMG for the plant(s). The details may be reviewed by the staff in an inspection. The time to complete these LRAs would be included in (1) the time to implement the approved amendment with the implementation date specified in the license amendment or (2) regulatory commitments specifying the LRA implementation dates, in accordance with Nuclear Energy Institute (NEI), “Guidelines for Managing NRC Commitments,“ dated June 9, 1995, in which safety significant changes to such commitments to NRC are discussed with NRC before the change is made. (See the amendments for the application dated July 14, 1999, for Arkansas Nuclear One, Units 1 and 2, TAC Nos. MA6062 and MA6063, respectively, after it is issued.)

With licensees implementing the above LRAs, the staff concludes, based upon the justification provided in WCAP-14986, that there is reasonable assurance that the health and safety of the public will not be endangered by operation of Westinghouse NPP without PASS.

5.0 CORE DAMAGE ASSESSMENT METHODOLOGY

In the letter of November 22, 1996, the WOG submitted Topical Report WCAP-14696, “Westinghouse Owners Group Core Damage Assessment Guidance,” for NRC review. In the topical report, a revised methodology was described that would be used by licensee emergency response organization staff for estimating the extent of core damage that may have occurred during an accident at a Westinghouse nuclear power plant. The revised methodology is a revised calculational technique for estimating core damage which relies on real-time plant indications rather than samples of plant fluids. The revised post-accident core damage assessment methodology (CDAM) in WCAP-14696 replaces the methodology approved by the staff in 1984. The 1984 methodology was revised for two major reasons: (1) the current methodology relies on radionuclide samples and does not effectively support emergency response decisionmaking due to the significant time delay in obtaining and analyzing these samples using the post-accident sampling system (PASS), and (2) the methodology does not reflect the latest understanding of fission product behavior, particularly the sequence-specific nature of fission product retention and hydrogen holdup in the RCS, and fission product deposition in the containment and sample lines.

In the staff’s letter of September 2, 1999, the staff approved WCAP-14696 for use by Westinghouse plants for core damage assessment. Because the staff concludes above, based upon the justification provided in WCAP-14986, that there is reasonable assurance that the health and safety of the public will not be endangered by operation of Westinghouse NPP without PASS without also concluding that the implementation of WCAP-14696 was necessary, the staff concludes that it is acceptable for licensees to eliminate PASS from the licensing basis for the Westinghouse NPP without incorporating the core damage assessment methodology in WCAP-14696 into its procedures; however, the licensees should assess the impact of elimination of PASS on their existing CDAM.

6.0 CONCLUSION

The staff concludes, based upon the justification provided in WCAP-14986, that there is reasonable assurance that the health and safety of the public will not be endangered by operation of Westinghouse NPP without PASS. Therefore, the staff concludes that it is acceptable for licensees to eliminate PASS from the licensing basis for the Westinghouse NPP. In eliminating PASS, the licensees do not have to incorporate the core damage assessment methodology in WCAP-14696 into its procedures, but they would need to assess the impact of elimination of PASS on their existing CDAM.

Attachment: Analysis of Public Comments

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APPENDIX

Analysis of Public Comments and Staff Response

In a notice published in the *Federal Reigster* on November 24, 1999 (64 FR 66213), the NRC requested comments on its pending action to approve two industry-developed topical reports concerning the elimination of the PASS. The NRC received 19 comment letters. Nine letters were from nuclear power plant utilities (supporting the proposed action), six letters were from State government organizations (four supporting and two opposing the proposed action), two letters were from private citizens (one supporting and one opposing the proposed action), one from an industry representative (supporting the proposed action) and one from the Federal Emergency Management Agency (supporting the proposed action). The staff grouped specific individual comments from each of the letters into a number of issue categories. These issues, the comments pertinent to the issue, and NRC response to insights provided in the comments are described below. Following the analysis of specific individual comments, a summary of all comments (general and specific) and the staff's response is provided.

1. Analysis of Specific Comments

Accuracy of PASS Results

One commenter agreed with the topical reports' contention that physical phenomena such as plateout and deposition in sample lines may cause PASS samples to underpredict the fission product inventories that are potentially available for release. A second commenter disagreed with the topical reports' contention on this issue, in particular regarding plateout of iodine in the sample lines and stated that an equilibrium will be reached (deposition equal to re-evolution) after the containment atmosphere has been circulated through the sample lines for a period of time.

The NRC considers the difficulty of obtaining representative samples to be a major shortcoming of the PASS system. The deposition of iodine is particularly problematic since iodine is the best indicator (from the PASS) for evaluating core damage and potential significance of health consequences from a release of the containment atmosphere. The amount of deposition of iodine will be a function of its chemical form. At the time that the PASS criteria were developed in NUREG-0737, the majority of iodine in the containment atmosphere from a potential severe accident was believed to be in elemental form. Since that time, severe accident research has shown that the chemical form of iodine is expected to primarily be Cesium Iodide (CsI) (as an aerosol). Collection of correct samples of the CsI aerosols poses significant problems. There will be a tendency for the particles to deposit on the cooler walls of sampling lines due to thermophoresis and Stefan flow, if steam is present. All these mechanisms will be present at all times during sampling operation and it is not expected that an equilibrium state between deposition and removal of the CsI aerosols will ever be reached.

Alternate Sampling Capability

Two commenters agreed with the topical reports' contention that samples could be obtained from non-PASS systems if an accident occurred. One commenter disagreed with the topical reports' contention that samples could be obtained from non-PASS systems if an accident occurred. The opposing commenter stated that there would be problems related to elevated hydrogen for rigging a sampling method. Furthermore, the commenter stated that any licensee requesting PASS elimination should be required to explain how they would accomplish containment atmosphere sampling with less personnel exposure than if they had a PASS.

The NRC is basing its decision on the acceptability of the proposal to eliminate PASS on the benefit that the information obtained from PASS would provide in accident management and emergency response. If this information was considered to be necessary and, therefore, planned to be obtained shortly after a severe accident, then a PASS would be prudent to ensure that samples could be taken promptly and exposure minimized. However, as described further in the summary to this Appendix, the information is not considered to be beneficial for accident management or emergency response. Therefore, there is considered to be sufficient time to establish an alternate sampling capability if samples were considered to be beneficial in the longer term.

Boron Sampling

One commenter disagreed with the topical reports' contention that boron sampling was not needed.

The NRC considers there are sufficient sources of borated water for injection by safety systems. Unborated water sources would only be used in an extremely unlikely circumstance and the use of unborated core cooling water would be balanced with the diminished potential for recriticality (given the core configuration). Furthermore, instruments are available for monitoring any potential recriticality. Knowledge of boron concentration is not a prerequisite of performing emergency operating procedures (EOP) or severe accident management (SAM) procedures.

Core Damage Assessment

Three commenters agreed with the topical reports' contention that PASS was not needed for performing core damage assessment (CDA). Two commenters raised concerns with the elimination of the use of PASS measurements for assessing the degree of core damage. The comments in support of the topical reports stated that other indicators exist which can be used for CDA. The comments disagreeing with the topical reports described the following shortcomings associated with these alternative indications.

- Radiochemical analysis of the coolant, containment sump and containment atmosphere is the most accurate method for performing CDA.

- A limitation of performing CDA based upon containment radiation monitor indication is that it is based upon the radiation monitor response to an assumed mixture of radionuclides. Since the nuclide mix varies greatly from one accident scenario to the next, the actual monitor response may vary by orders of magnitude.

- A limitation of performing CDA based upon core exit thermocouples (CETs) is that CETs cannot be used to determine whether fuel overheat or pellet melting has occurred.

- A limitation of performing CDA based upon hydrogen monitor readings is it can only assess whether the fuel is overheating (not whether the fuel has melted) and there are uncertainties associated with the hydrogen generation rate and mixing of the hydrogen in containment.

The staff recognizes that there are limitations with the individual indications used for CDA which is why current guidance relies on a number of instrument indications to diagnose and evaluate core damage. The staff agrees that radiochemical analysis is more accurate than other available indications but it too has limitations. At the time of PASS design, the iodine chemical form was assumed to be predominantly in elemental gaseous form (91 percent). The staff's current understanding is documented in NUREG/CR-5732, which indicates that iodine entering the containment is at least 95 percent particulate CsI. Once the iodine enters containment, however, additional reactions are likely to occur. In an aqueous environment, as expected for LWRs, iodine is expected to dissolve in water pools or plateout on wet surfaces. This can bias the radionuclide samples obtained from PASS and lead to underestimates of the extent of core damage.

The staff agrees that the nuclide mix varies greatly from one accident scenario to the next which affects radiation monitor response. Revised CDA guidance relies on CETs, RCS pressure and containment spray system status to sufficiently narrow the accident scenario being assessed and the expected variation in the nuclide mix.

The approach for converting instrument readings into core damage estimates is consistent with the current understanding of clad and fuel damage characteristics, and accounts for fission product and hydrogen retention/holdup in an approximate fashion. Specifically, containment radiation monitoring readings are compared to plant-specific radiation levels for 100 percent clad damage or fuel over-temperature damage, CET readings are compared to values typically associated with clad damage and fuel over-temperature damage, and containment hydrogen concentration is compared to the amount expected in containment for 100 percent over-temperature damage. CET readings that exceed the setpoints or the operating limits of the thermocouples are interpreted as core damage in that region of the core. The core damage estimates derived separately from different indicators (containment radiation, CET, and containment hydrogen concentration readings) are compared and reconciled, thereby improving the confidence in the core damage estimate.

The staff has concluded that the revised CDA guidance, that does not rely on PASS, provides the capability to assess the degree of core damage with a sufficient level of accuracy and timeliness to support emergency response decisionmaking. The revised guideline represented an improvement over the existing methodology which relied on PASS sampling. It is both simpler and more timely, and accounts for improved understanding of fission product behavior inside containment. By making core damage information available earlier in an event, such that it can be used to refine dose assessments and confirm or extend initial protective action recommendations, implementation of the revised CDA guidance should increase the effectiveness of the emergency response organization.

Dose Assessment

Two commenters agreed with the topical reports' contention that PASS was not needed for performing dose assessment. One commenter raised concerns with the elimination of the use of PASS measurements as inputs for dose assessments. The comments in support of eliminating this PASS measurement stated that installed instrumentation, which provides real time information from diverse parameters, is much better than PASS samples and that computer models although useful need to be verified by offsite field team measurements. The commenter disagreeing with the topical reports stated that field team measurements have inaccuracies associated with atmospheric transport, field team measurements may not be timely, and that there is a large uncertainty associated with source term estimate based upon in-plant instrumentation.

The NRC expects dose assessments to be timely and accurate in order to support decisions on protective actions for the public. However, the NRC recognizes that there are limitations on the accuracy and timeliness of dose assessments. Therefore, the NRC guidance (reference NUREG-0654, Supplement 3) specifies that initial protective action recommendations should be based upon plant conditions which indicate that there is actual or projected severe core damage. This initial PAR is followed by dose assessments which may be used to expand the area covered by the initial PAR. Initial dose assessments will likely be based upon an assumed source term. This source term may be refined based upon plant indications or core damage assessments. This source term can be further refined based upon offsite field team measurements. (A benefit of using field team measurements is that the source term being estimated is that released from containment rather than the source term in containment which could be altered prior to being released from containment). PASS results are another potential input to refinements to the source term. However, there are concerns with the accuracy of source term estimates based upon PASS because of the potential for the sample not to accurately represent the source term in containment and with the time needed to obtain and analyze these samples.

The NRC believes that PASS results will not have an important role in source term refinements for use in dose assessments because indications such as core exit thermocouple and containment radiation monitor (in conjunction with correlations of these indications to core damage assessments) will be more timely for refining source term estimates and indications such as field team measurements will be more accurate in refining the source term estimates.

Event Classification

Two commenters agreed with the topical reports' contention that PASS was not needed for classifying events.

The NRC agrees that other indications are available for classifying events involving fuel damage and these other indications are available in a more timely manner than PASS.

Hydrogen Measurement

One commenter agreed with the topical reports' contention that PASS was not needed for hydrogen measurement and one commenter raised concerns with elimination of PASS hydrogen monitoring. The comment in support of eliminating hydrogen sample measurement was that the hydrogen monitoring system provided measurement of hydrogen in containment and that this measurement is much quicker than measurements using PASS. The opposing comment was that the hydrogen sample from PASS provides an independent method of determining the hydrogen concentration.

The NRC considers that hydrogen measurement utilizing the PASS system is not needed because the hydrogen monitoring system can provide the same information in a more timely manner. The hydrogen monitoring system is subject to quality assurance requirements and is a redundant system.

Plant Access/Post Accident Leakage/Personnel Exposure

Two commenters provided comments in support of the topical reports contention that elimination of PASS will prevent the potential for restriction of plant access following a PASS sample, will reduce personnel exposure, and will eliminate a potential post accident leakage path.

The NRC agrees with these comments. However, the NRC recognizes that the PASS was to be designed to prevent the potential problems and that the decision to obtain a PASS sample would take into account the benefit of the PASS sample in light of the potential for restricting plant access, exposure of personnel and leakage.

Protective Action Recommendations

Six commenters agreed with the topical reports' contention that development of protective action recommendations will not be affected by the deletion of PASS. Two commenters disagreed with the topical reports' contention on this issue.

The comments in support of eliminating PASS stated that PASS samples are not useful in protective action decisionmaking because these decisions are based on plant indications (real-time monitoring instruments and system operability) and offsite field surveys.

The comments against eliminating PASS stated that offsite officials need to know the actual volume of radioactive material inside of containment (not just the inferred source term) to make additional protective action recommendations.

The NRC considers that PASS may be useful in making subsequent protective action recommendations (or confirming the initial PAR) after the initial protective action recommendation has been made. However, the NRC considers that there is adequate information on the actual (or potential) consequences of a release of radioactive material from field team measurements and containment atmosphere radiation monitors to support assessment of protective action recommendations.

Resources

Four commenters agreed with the topical reports' contention that obtaining and analyzing PASS samples may divert resources from other important emergency response activities.

The NRC does not consider the potential for diverting resources to be a problem because the decision to obtain a PASS sample should be based upon an evaluation of what is the most important activities to perform during the accident.

Severe Accident Management Guides

One commentator disagreed with the topical reports' contention that PASS is no longer required during emergency response in part because of the implementation of Severe Accident Management Guidelines (SAMGs) at nuclear power plants.

The staff does not consider SAMGs to be a replacement for PASS. The SAMGs were intended to provide guidance to the plant operator under severely degraded accident conditions that are outside the plant design and licensing basis. Based on in-plant instrument readings, the core damage state is classified as "in-vessel" or "ex-vessel". Because of PASS limitations, the staff concludes that core damage assessment can be provided with a sufficient level of accuracy and timeliness to support emergency response decision making and SAMG implementation without the PASS. The basis for this conclusion is summarized in the above "Core Damage Assessment" section of this document.

Sump pH

Two commenters disagreed with the topical reports' contention concerning the need for pH measurement from PASS. One commenter stated that knowledge of sump pH will confirm or deny that pH is within design limits and that this information will allow emergency response staff to address pH concerns or to be free to address more pressing concerns (if pH is adequate). The second commenter stated that the NRC should be assured that there is a fool-proof way of buffering recirculation water.

The NRC considers that the chemicals added to the sump water by either trisodium phosphate stored in the sump or sodium hydroxide added to the spray water will provide sufficient buffering action to account for the effect of the major acidic chemicals present in the containment sump after an accident. It is not expected that any unaccounted for acidic substances generated in the sump will significantly lower its pH. Its reevaluation during the accident will not, therefore, be needed, especially since no additional means for pH control will then be available.

System Operation Verification

The commenter stated that PASS data can be used to verify that safety features are operating as designed.

The NRC considers that there may be some benefit to PASS in providing information on the effectiveness of system operation. However, the NRC considers that there are alternative indications which are available in a more timely manner for this purpose.

2. Summary

In addition to the specific comments extracted from the comment letters, many commenters provided a general assessment of the need for PASS. The commenters in support of elimination of PASS stated that PASS information is not used in emergency response and will not adversely affect emergency response, that resources are better used in other areas of emergency response, and that the cost of PASS does not warrant maintaining the system. Commenters opposing elimination of PASS stated that PASS will provide information useful in emergency response.

The NRC appreciates the time and effort taken by all the commenters. Input from the public stakeholders is an important part of the NRC's decision making process. The NRC concludes, as detailed in the body of this safety evaluation, that the PASS has a small benefit in emergency response. The primary benefit is in confirming other indications used to make emergency response decisions. The benefit of PASS is limited by the time needed to obtain the samples and problems with obtaining accurate samples (in particular radioisotopic samples of the containment atmosphere). The NRC concludes that elimination of PASS will not pose a significant hazard to the public and that continued imposition of NRC orders requiring PASS is not warranted.

It is expected that licensees will utilize the industry topical reports and the NRC's safety evaluation in requesting elimination of PASS at their plants. The NRC will provide the public an opportunity to comment on plant requests for elimination of PASS as part of the license amendment process. Therefore, the public will have the opportunity to raise any site-specific concerns related to elimination of PASS at that time.